



Article

The Sleep of Shift Workers in a UK Financial Organisation and Associations with Mental, Physical, Social and Cognitive Health

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Abstract: Shift workers are vulnerable to circadian misalignment, sleep disturbance and increased risk of impaired health. Studies concerning the sleep and health of individuals working shifts in the financial sector are lacking. We investigated sleep quality, sleep duration and associations with health in a UK financial organisation. Employees ($n = 178$; 61% male) completed an online survey comprising the SSI, PSQI, GAD-7, PHQ-9, WAFCS, EMQ-R and BMI. Three-quarters of employees reported poor sleep quality. Poorer sleep quality and shorter sleep duration were both associated with greater anxiety and depression symptoms. However, sleep quality demonstrated greater explained variance with symptom severity (anxiety: R_s^2 difference = 13.2%; depression: R_s^2 difference = 21.8%). Poorer sleep quality was associated with higher BMI, greater work-to-family conflict and poorer everyday memory ($r_s = 0.26$ – 0.29), while shorter sleep duration was only significantly associated with higher BMI. Sleep quality did not differ depending on the nightshift type (“permanent”/“other”). Sleep achieved was shorter than perceived sleep-need for all consecutive shift types—especially night shifts (40 min–1 h 24 min). This preliminary study suggests that sleep quality, and to a lesser extent sleep duration, are associated with a range of health outcomes for shift workers within the financial sector, highlighting the need to increase organisational awareness of the importance of sleep for employee health.

Keywords: shift work; shift schedules; sleep quality; sleep duration; health; financial sector



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1. Introduction

Shift work is commonplace in today’s 24/7 society, and it is estimated that approximately 20% of working adults participate in shift work globally [1]. Shift work refers to working outside standard daytime hours and may encompass a variety of schedules that include fixed or rotating morning, evening and night shifts [2]. Atypical work hours and schedules force rapid alterations in the sleep–wake and light–darkness schedules to which the central clock, located within the suprachiasmatic nuclei (SCN), and peripheral clocks are entrained to allow an optimum physiological and behavioural response to the varied demands of the 24 h day [3]. Shift workers are therefore vulnerable to circadian misalignment—a state of desynchronization between the circadian system and the environment—as well as internal desynchronization between levels of the circadian system [3,4].

Shift workers are at increased risk of developing chronic sleep disturbances and experiencing insufficient sleep and poor sleep quality [5–8]. Compared to those who work regular shift schedules, individuals who rate their schedule as irregular report lower sleep quality [9]. Night shifts necessitate working through the normal sleeping hours of 12 midnight to 6 am [10], affecting rhythms controlled by the central and peripheral clocks. Permanent nightshift workers have been found to get more sleep than rotational

shift workers [11]; however, sleep complaints are more common in permanent night workers [12]. Studies have investigated the links between shift work and multiple indicators of poor mental, physical, social and cognitive health. A systematic review and meta-analysis found that shift work was associated with poorer mental health [13], while a meta-analysis of longitudinal studies showed that shift work was associated with an increased risk of adverse mental health outcomes and that shift workers had a 33% higher risk of depressive symptoms than non-shift workers [14]. Indicators of poorer physical health in shift workers include increased risk of weight gain, higher BMI and obesity [10,15,16]. Shift schedules and sleeping outside standard hours may constrain family, social and leisure activities, creating obstacles to a healthy work–life balance [14,17]. Shift workers have shown higher levels of work–family conflict, referring to the conflict between meeting the demands of the work and the family domain, than those who work regular day schedules [18]. Lastly, shift work—especially if it takes place at night—has been found to be associated with impairments in cognitive functions [3]. A recent systematic review suggested that the circadian misalignment and sleep loss resulting from shift and night work can negatively impact cognitive performance, including the domains of attention and memory [19]. Individual responses to shift work and susceptibility to negative health effects can vary by gender [7], with some evidence supporting the incidence of more sleep-related problems in women working shifts than in men [20].

Research into shift work and sleep has focused predominantly on those in the health-care [21], manufacturing [22] and transportation [23] sectors. Although it has been assumed that the impact of shift work will be the same across different occupations, empirical evidence is lacking. This preliminary study focuses on shift work schedules, sleep and health in a population of white collar/financial workers which, to our knowledge, has not been examined in any detail to date. We investigate potential associations between sleep quality, sleep duration and health in this group. Furthermore, we explore whether sleep quality and sleep duration differ by nightshift type and whether differences exist between employees' reported sleep need and sleep duration for those working consecutive shifts.

2. Methods

2.1. Participants and Procedure

All participants who took part in this cross-sectional, survey-based study were employed by a large UK financial organisation. The organisation identified individuals (approximately 900) who worked shifts within their work force and emailed these employees to inform them about the study with a link to an online survey. Individuals interested in taking part could follow the link to a webpage with further information about the study and provide online consent to participate before accessing the survey. No incentives were offered for taking part and survey questions were not mandatory. Employees were informed that individual responses would not be shared with their workplace. The data were collected without names or using unique logins; instead, responses were given a unique participant identification number. The survey was available via Qualtrics, an online survey platform, for approximately two weeks in November 2021 and employees were sent an email reminder about the survey before it closed. The study was approved by the University of Oxford Medical Sciences Division Research Ethics Committee (R77786/RE001) on 19th October 2021.

2.2. Measures

2.2.1. Shift Schedule and Sleep Duration

Shift schedule items were taken from the Working Time group's Standard Shiftwork Index [24]. The regularity of shift system was investigated with three response options: regular (a fixed roster which is repeated when the cycle of shifts finishes, even if occasional variations occur to meet special requests), irregular (the duty roster does not cycle or repeat in any regular manner and individual preferences are not taken into account), or flexible (individuals are consulted about preferred duty hours before the duty roster is drawn up).

Employees were asked how night shifts are organised and responses were subsequently categorised as either “permanent nightshift” or “other”.

The perceived need for sleep duration was assessed with one question “How many hours sleep do you feel you usually need per day, irrespective of which shift you are on?”. Sleep duration for different shift types worked consecutively (night, evening, morning, day) and days off was assessed for individuals by asking how many hours of sleep on average they usually achieved for appropriate shifts and days off. Participants were asked to provide sleep duration times to the nearest half an hour.

2.2.2. Sleep Quality

Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI) [25], an 18-item measure of sleep quality with seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction. Each component is scored from 0–3 and summed to give a global score (range: 0–21); higher scores indicate poorer sleep quality, and scores higher than 5 are indicative of poor sleep quality.

2.2.3. Health and Social Indicators

Mental health was assessed with the Generalised Anxiety Disorder 7-item version (GAD-7) [26], for anxiety symptoms, and the Patient Health Questionnaire 9-item version (PHQ-9) [27] for depression symptoms. Each item is scored on a 4-point scale (0 = not at all, 3 = nearly every day). Higher scores indicate greater symptom severity (GAD-7: range: 0–21; PHQ-9: range: 0–27). Body Mass Index (BMI; kg/m²) was calculated from self-reported height and weight, and was used as a marker of overall physical health. Social health was assessed using the 5-item Work-to-family conflict subscale (WFC) taken from the Work–Family Conflict Scale (WAFCS) [28]. Each item is scored on a 7-point scale (1 = very strongly disagree, 7 = very strongly agree). Items are summed to provide the total WFC score (range: 7–35). Higher scores indicate higher levels of conflict. Cognitive health was assessed using the revised Everyday Memory Questionnaire (EMQ-R) [29]. This 13-item questionnaire measures an individual’s beliefs about memory performance in everyday life. Each item is scored on a 5-point scale (0 = once or less in the last month, 4 = once or more in a day). The total score is the mean of all items. Higher scores indicate greater everyday memory failure.

Finally, sample characteristics including demographic information on gender, age, and ethnic group were collected. Employees were asked to provide work information, including how long they had worked in their current role and their current shift schedule, as well as the arrangement that best described their place of work: “Home-based” (predominantly at home but sometimes in the office), “Hybrid” (both home and the office) or “Office-based”. This workplace arrangement had been in operation for over a year, following the end of the first COVID-19 lockdown in the UK.

2.3. Statistical Analyses

Participants were excluded from the sample if they did not provide at least their demographic and basic sleep information. Descriptive statistics are presented as either frequencies and percentages for categorical variables, or as means and standard deviations for continuous variables. Participant responses to a questionnaire (PSQI, GAD-7, PHQ-9, WFC, EMQ-R) were included in analyses if participants had responded to each item, so that subscale (where applicable) and total scores could be calculated. Consequently, sample sizes differed depending on measure completion. Independent *t*-tests and one-way ANOVAs were used to examine differences between groups. Chi-square tests were used to assess associations between categorical variables. Scores for GAD-7, PHQ-9, BMI and EMQ-R were positively skewed. Accordingly, Spearman’s rho tests were performed to examine correlations between continuous variables: sleep parameters (sleep quality, sleep duration), mental health (anxiety and depression symptoms), physical health (BMI), social

health (work-to-family conflict) and cognitive health (everyday memory). Dependent *t*-tests were conducted to examine differences between self-perceived sleep need and sleep duration achieved for consecutive shift types. All data were analysed using SPSS 28 (IBM, Armonk, NY, USA). A *p*-value < 0.05 was interpreted to indicate statistical significance.

3. Results

3.1. Sample Characteristics

This analysis excludes 34 log-ins where consent to take part was provided but no responses were given, 39 which provided only very short responses (e.g., only demographics), and 27 which provided no responses to sleep measures. Data are included from 178 employees—see Table 1. The majority of employees were aged between 25 and 54 years (79%), male (63%), white (93%), had worked in their current role for five years or more (64%), reported regular shift schedules (96%) and were office-based (53%).

Table 1. Characteristics of employee sample: demographics and work information.

	<i>n</i>	%	Total <i>n</i>
Age in years			178
18–24	10	5.6	
25–34	47	26.4	
35–44	44	24.7	
45–54	49	27.5	
55 or older	28	15.7	
Gender			178
Male	112	62.9	
Female	65	36.5	
Prefer not to say	1	0.6	
Ethnic group			178
White	166	93.3	
Other ethnic group	10	5.7	
Prefer not to say	2	1.1	
Worked in current role			178
Up to 5 years	64	36.0	
5 years or more	114	64.0	
Worked current shift schedule			178
Up to 5 years	95	53.4	
5 years or more	83	46.6	
Work place arrangement			178
Home-based	29	16.3	
Hybrid	55	30.9	
Office-based	94	52.8	
Regularity of shift schedule			174
Regular	167	96.0	
Irregular	4	2.3	
Flexible	3	1.7	
How night shifts are organised			113
Permanent nightshift	39	34.5	
Other	74	65.5	

3.2. Employee Sleep and Health

An overview of means and standard deviations for sleep and health variables is shown in Table 2. There were no significant differences between male (7.70 (SD 3.56)) and female employees (8.89 (SD 3.73)) in the PSQI global score as a measure of sleep quality ($t = -1.79, p = 0.08$), or between male (6:16 (SD 1:10)) and female employees (6:04 (SD 1:11)) in self-reported sleep duration on the PSQI ($t = 1.03, p = 0.31$). Due to the small numbers taking part in the youngest group, the two younger age groups were combined into one category (18–34 years) before the age group analysis. Age groups did not significantly differ on the PSQI global score (18–34: 7.70 (3.78); 35–44: 8.24 (3.72); 45–54: 8.72 (3.39); 55 or

older: 7.92 (3.92); $F(3, 126) = 0.51, p = 0.68$) or sleep duration (18–34: 6:30 (1:11); 35–44: 6:07 (1:14); 45–54: 6:00 (1:00); 55 or older: 5:55 (1:20); $F(3, 162) = 2.13, p = 0.10$). Employees did not report significant differences based on working arrangements (home-based, hybrid, office-based) for PSQI global scores ($M = 7.30, 8.90, 8.01$); $F(2, 127) = 1.51, p = 0.23$) or sleep duration ($M = 6:16, 6:08, 6:10$; $F(2, 163) = 0.10, p = 0.91$).

Table 2. Means and standard deviations for sleep and health variables.

	Measure	N	Mean	SD
Sleep quality	PSQI global score	130	8.16	3.66
Sleep duration (hh:mm)	PSQI	166	6:10	1:11
Anxiety symptoms	GAD-7	161	4.29	4.87
Depression symptoms	PHQ-9	160	6.25	5.28
BMI	BMI	124	27.73	5.40
Work-to-family conflict	WAFCS	166	18.11	6.43
Everyday memory	EMQ-R	146	0.96	0.86

Note. Discrepancies in sample size are due to missing or incomplete responses.

Figure 1 illustrates the percentages of employees reporting good and poor sleep quality (PSQI global score > 5). The majority of employees (75%) reported poor sleep quality. Sleep quality category was not significantly associated with gender ($X^2 = 3.52, p = 0.06$), and the majority of both males (70%) and females (85%) reported poor sleep quality.

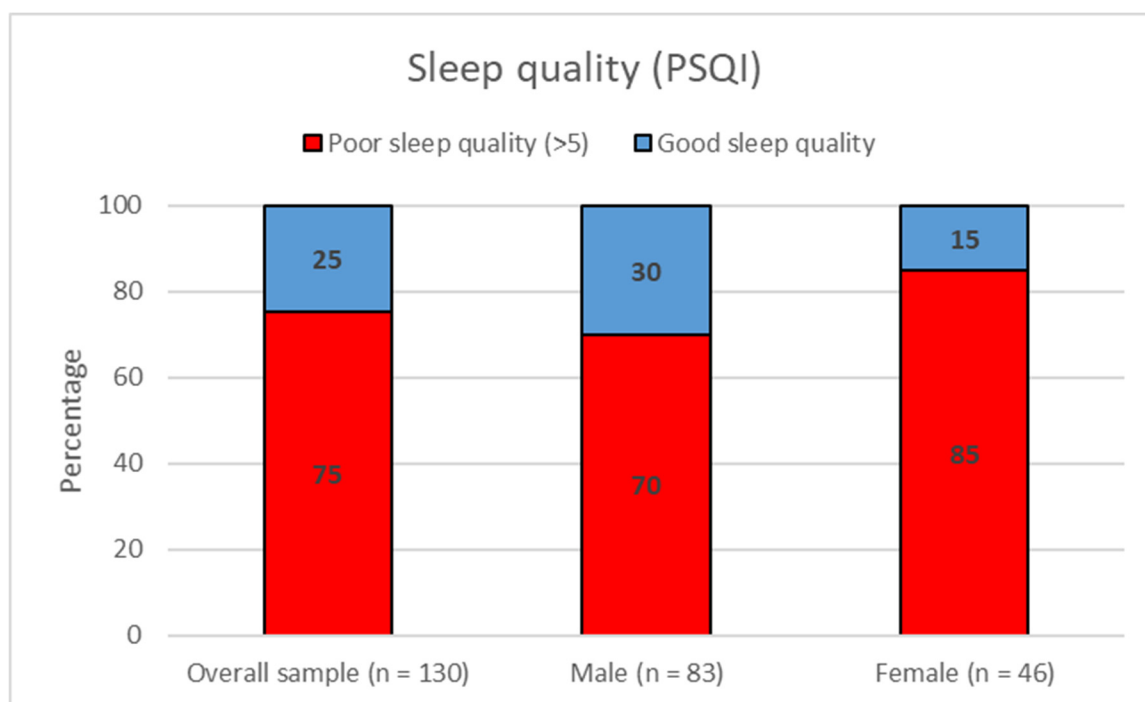


Figure 1. Good and poor sleep quality % for overall sample, males and females.

3.3. Association of Sleep with Health Indicators

Associations between employees' sleep quality (PSQI global score; note that higher scores indicate poorer sleep quality) and sleep duration with health indicators are shown in Table 3. A moderate positive correlation was observed between sleep quality and anxiety symptoms ($r_s = 0.41, R_s^2 = 16.8\%$), while a strong positive correlation was found between sleep quality and depression symptoms ($r_s = 0.53, R_s^2 = 28.1\%$). Sleep duration was negatively related to anxiety symptoms ($r_s = -0.19, R_s^2 = 3.6\%$) and depression symptoms ($r_s = -0.25, R_s^2 = 6.3\%$). To summarise, poorer sleep quality and shorter sleep duration

were significantly related to higher reported levels of anxiety and depression symptoms. However, sleep quality demonstrated a greater explained variance with symptom severity than was found with sleep duration (anxiety symptoms: R_s^2 difference = 13.2%; depression symptoms: R_s^2 difference = 21.8%).

Table 3. Correlations (Spearman's rho) between sleep and health measures.

	PSQI	Sleep Duration	GAD-7	PHQ-9	BMI	WFC
PSQI	-					
Sleep duration	-0.71 *** <i>n</i> = 129	-				
GAD-7	0.41 *** <i>n</i> = 126	-0.19 * <i>n</i> = 158	-			
PHQ-9	0.53 *** <i>n</i> = 125	-0.25 ** <i>n</i> = 157	0.80 *** <i>n</i> = 160	-		
BMI	0.26 * <i>n</i> = 99	-0.26 ** <i>n</i> = 121	0.01 <i>n</i> = 124	0.07 <i>n</i> = 123	-	
WFC	0.29 *** <i>n</i> = 128	-0.10 <i>n</i> = 163	0.34 *** <i>n</i> = 161	0.43 *** <i>n</i> = 160	0.11 <i>n</i> = 124	-
EMQ-R	0.29 ** <i>n</i> = 115	-0.07 <i>n</i> = 143	0.57 *** <i>n</i> = 146	0.62 *** <i>n</i> = 145	0.05 <i>n</i> = 117	0.36 *** <i>n</i> = 146

Note. PSQI = PSQI global score, Sleep duration = sleep duration taken from PSQI, GAD-7 = anxiety symptoms, PHQ-9 = depression symptoms, BMI = Body Mass Index, WFC = work-to-family conflict, EMQ-R = everyday memory performance. Higher PSQI scores indicate poorer sleep quality. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

When considering BMI, similar small effect sizes were observed with both sleep quality and sleep duration; sleep quality was positively correlated ($r_s = 0.26$, $R_s^2 = 6.8\%$), while sleep duration was negatively correlated ($r_s = -0.26$, $R_s^2 = 6.8\%$) with BMI. Lastly, both work-to-family conflict ($r_s = 0.29$, $R_s^2 = 8.4\%$) and everyday memory performance ($r_s = 0.29$, $R_s^2 = 8.4\%$) showed similar small positive correlations with sleep quality, but no significant correlations with sleep duration.

3.4. Sleep Quality and Night Shift

Next, for those who worked night shifts, whether sleep quality differed depending on how these shifts were organised was evaluated. There was no significant difference in sleep quality score between those who worked “permanent nightshifts” (8.34 (SD 3.39), $n = 29$) and those grouped as “other” (7.56 (SD 3.32), $n = 55$; $t = 1.02$, $p = 0.31$). Furthermore, sleep quality category (i.e., good and poor sleep quality) was not significantly associated with nightshift type ($X^2 = 0.44$, $p = 0.51$).

3.5. Sleep Need and Sleep Duration Achieved by Consecutive Shift Type

A total of 65 employees (38.5%) reported one consecutive shift type worked, 53 employees (31.4%) reported two shift types, 14 employees (8.3%) reported three shift types and 37 employees (21.9%) reported four shift types ($n = 169$). Employees' perceived sleep duration need and self-reported sleep duration achieved for different shift types worked consecutively (night, evening, morning, day) and days off are presented in Table 4. Notably, sleep need was significantly greater than sleep achieved for all shift types (p -values all < 0.003). In comparison to sleep need, sleep duration achieved was significantly shorter on consecutive night shifts (1 h 24 min, 95% CI, 1 h 8 min–1 h 39 min), on consecutive evening shifts (45 min, 95% CI, 17 min–1 h 13 min), on consecutive morning shifts (44 min, 95% CI, 25 min–1 h 3 min) and on consecutive day shifts (40 min, 95% CI, 24 min–57min). However, no significant difference was found between sleep need and sleep achieved on days off ($p = 0.11$).

Table 4. Self-perceived sleep need per day and sleep duration achieved for consecutive shift types/days off.

Variable (hh:mm)	Mean	SD	<i>n</i>	<i>t</i>	<i>p</i>
Sleep need	7:08	1:08	118	10.81	<0.001
Night shift sleep duration	5:44	1:17			
Sleep need	7:17	1:18	54	3.21	0.002
Evening shift sleep duration	6:32	1:24			
Sleep need	7:14	1:13	74	4.73	<0.001
Morning shift sleep duration	6:29	1:07			
Sleep need	7:14	1:11	115	4.85	<0.001
Day shift sleep duration	6:33	1:09			
Sleep need	7:12	1:11	132	−1.62	0.11
Days off sleep duration	7:26	1:34			

Note. Results shown are for dependent *t*-tests. Participants report sleep need once but sample size and means (SD) vary depending on whether participants also report sleep duration for particular consecutive shift type or days off.

4. Discussion

This study, for the first time, provides insights into the sleep of shift workers from the financial sector and associations between their sleep and health. We found that poor sleep quality, assessed using the PSQI, was experienced by 75% of employees who responded to the survey. This agrees with a previous study using the PSQI, where poor sleep quality was reported by 78% of shift working nurses [6]. Although a higher proportion (85%) of female employees experienced poor sleep quality compared with male employees (70%), the association with gender did not reach statistical significance. Furthermore, sleep quality (PSQI global score) and sleep duration did not differ by gender, age group or working arrangement (home-based, hybrid, office-based).

Sleep quality, and to a lesser extent self-reported sleep duration, were associated with anxiety (GAD-7) and depression (PHQ-9) symptoms. Our findings suggest that shift workers who were experiencing poorer sleep quality, as well as those reporting shorter sleep duration, were also experiencing higher symptom severity. The strengths of these associations indicate that employees' perceived sleep quality may be more closely linked than the amount of sleep achieved to these measures of mental health. Moreover, effect sizes revealed that links between both sleep quality and sleep duration were stronger with depression symptoms than anxiety symptoms. While these findings can be interpreted as reiterating the importance of sleep for mental health, it is important to acknowledge that we do not know the direction of the association and that the relationship between sleep and emotions has been described as bidirectional [30].

Associations between sleep and other health measures in this study were found, but were not as strong. Both sleep quality and sleep duration were associated with BMI, albeit with small effect sizes. This is consistent with research demonstrating that poor sleep quality is a lifestyle factor that mediates the relationship between shift work and obesity [15]. Furthermore, although shift work has been associated with obesity in a large UK sample, strong evidence was not provided for the association between shift work and BMI being dependent on sleep duration [10]. Work-to-family conflict and everyday memory performance were related to sleep quality but not to sleep duration. One potential explanation for this discrepancy may be that the measure of sleep quality used in this study could be considered a more comprehensive measure of sleep than duration alone. The PSQI global score considers a number of factors that affect sleep quality, of which duration is only one of seven.

For those working night shifts, neither sleep quality nor sleep duration differed depending on whether employees experienced permanent nightshifts or not, suggesting that sleep may not be linked to how these shifts are organised. This is consistent with evidence that the circadian system is resistant to adaptation to night shift work [3]. Employees were asked to provide hours of sleep achieved when working consecutive shift types.

Sleep duration reported on consecutive night shifts was shortest (5 h 44 min), whereas the sleep achieved was remarkably similar for evening shifts (6 h 32 min), morning shifts (6 h 29 min) and day shifts (6 h 33 min). This falls within the range of daytime sleep periods of nightshift workers, which were reported to be curtailed after 4 to 6 hours [31] and similar to the finding that daytime sleep after a night shift for those involved in rotating shift work was 5 h 51 min [32]. When comparing sleep to the National Sleep Foundation's sleep duration recommendations [33], only sleep on days off (7 h 26 min) met recommended hours, whereas evening, morning and day shifts fell into "may be appropriate" and sleep on consecutive night shifts fell into "not recommended". These findings should be interpreted alongside the caveat that interindividual differences in sleep need and impairment from sleep loss exist [34]. Notably, self-reported sleep duration was shorter than perceived sleep need for all shift types. Shift workers working consecutive night shifts reported the greatest discrepancy of 1 h 24 min on average, while other shift types reported discrepancies between 40 and 45 min.

The findings reported here should be viewed as preliminary and be interpreted cautiously, and a number of limitations need to be considered. The sample size of the study was relatively small. Only 178 out of around 900 employees completed the survey items detailed in this study. This response rate of approximately 20% is low and may bring into question the representativeness of collected data. Sleep quality was not found to significantly differ with gender, and we acknowledge that this finding may in part be explained by the previously noted sample size of the study. Only shift workers were investigated and so it is not possible to conclude whether sleep and health problems are more common in shift workers than non-shift workers (e.g., those who solely work days) in this organisation. The cross-sectional nature of the study design means that causality cannot be explored. Prospective studies would be required to help inform the nature of the associations between sleep quality, sleep duration and health in shift workers. It was not possible to investigate potential links between sleep and the regularity of shift schedules, as 96% of workers reported regular shift schedules. We also did not collect information on how quickly participants rotated through different shift types, which has been identified as a factor impacting sleep duration in shift workers. For example, workers on slowly rotating schedules (4–7 consecutive shifts of the same type) slept 25 minutes longer on average than those on rapidly rotating schedules (1–3 similar shifts in a row) [5]. However, a study that measured the sleep duration of Danish police officers using actigraphy found that sleep duration did not increase with more consecutive night shifts [35]. The type of work performed by shift workers within the financial organisation was not included as part of this study. However, an investigation into the sleep of shift workers in different types of roles may help to shed light on whether an individual's sleep quality is linked to their particular employment as well as potential circadian rhythm disruption. We recommend more extensive studies to compare the sleep and health of shift workers in the financial sector with those in other areas: for example, in healthcare, manufacturing and transportation. Findings based on the same measures, and taken from employees working similar shifts across sectors, would help to establish whether the sleep and health of financial shift workers differ from shift workers in other types of employment.

5. Conclusions

These findings largely support previous research on the health correlates of sleep in shift workers but have added to our knowledge by focusing on employees from a different sector of the working population. The study indicates that poor sleep quality may be the norm rather than the exception for these workers, and that sleep needs are not being met. Our findings underline the value of increasing awareness about the importance of sleep for all categories of shift workers—especially through the use of sleep education programmes. Future research is recommended to investigate whether interventions targeting sleep and circadian rhythm disruption could improve both the sleep and health of shift workers in the financial sector.

Author Contributions: G.I. collected the data, conducted the data analysis and wrote, reviewed and edited the manuscript. W.R.M. conceptualised and designed the study and reviewed and edited the manuscript. D.G. conceptualised and designed the study and administered and supervised the project. S.P. conceptualised and designed the study. R.G.F. conceptualised and designed the study, supervised the project and reviewed and edited the manuscript. All authors have read and agreed to the published version of the manuscript.

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